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G09F G09G

(54) Planar light emitting device

(57) A planar light emitting device for use with, for example, a liquid crystal display panel 13, comprising a body 1 which is formed of a transparent synthetic resin, a light emitting panel 2 which has one surface 2*a* thereof worked into a prism in correspondence with the liquid crystal display panel 13 and which has reflective sheets 10*a*, 10*b* respectively stuck on slanting surfaces 7*a*, 7*b* formed on both surfaces thereof, a plurality of light sources 4 which are disposed at positions not opposing to the light emitting panel 2, and a light guide plate 12 which is thinned in a wedge shape as it becomes more distant from the light sources 4. The device may be used in a telephone.

FIG. 1b

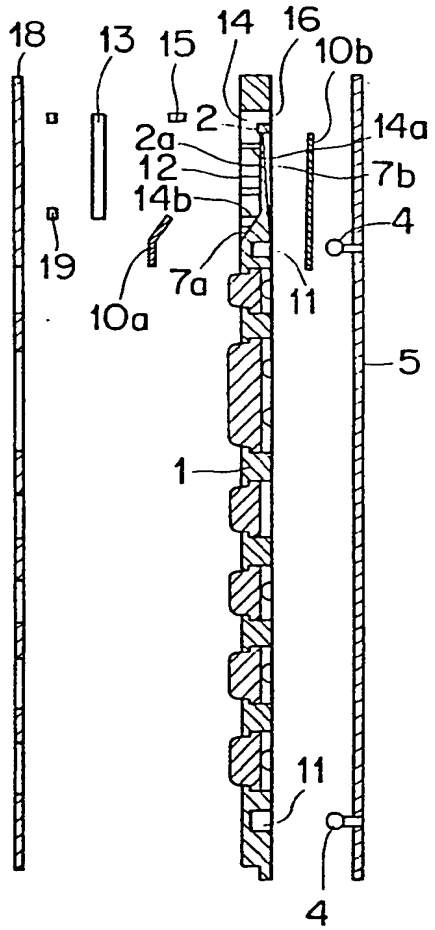

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FIG. 2a

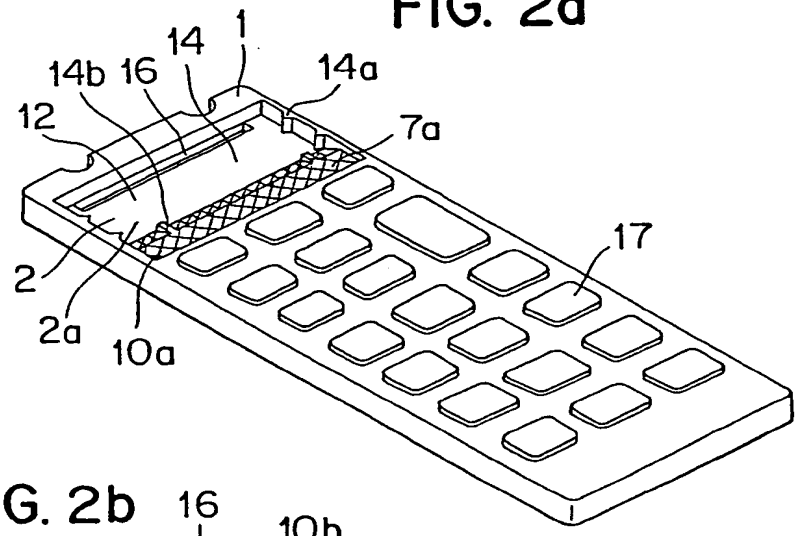

FIG. 2b

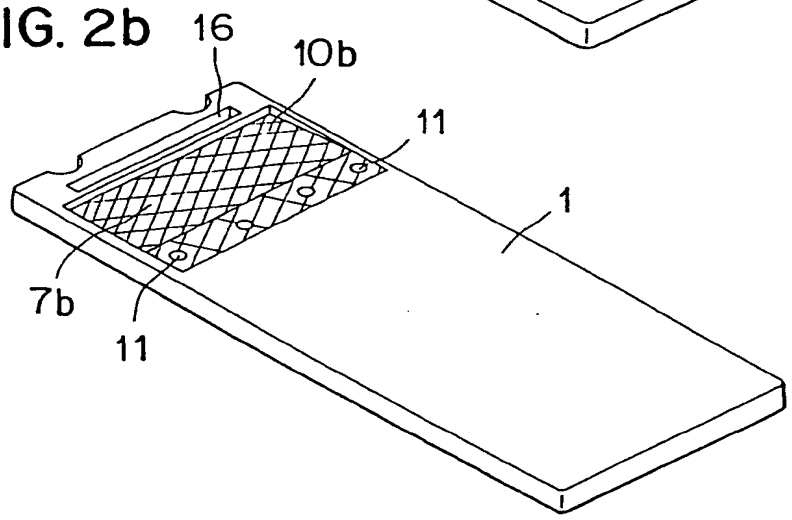

FIG. 5a

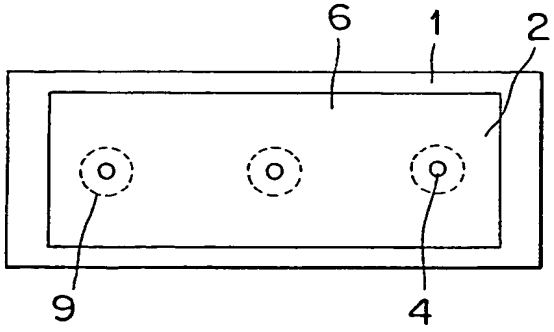

FIG. 5b

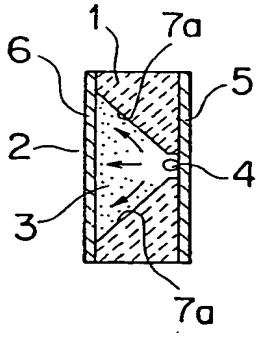

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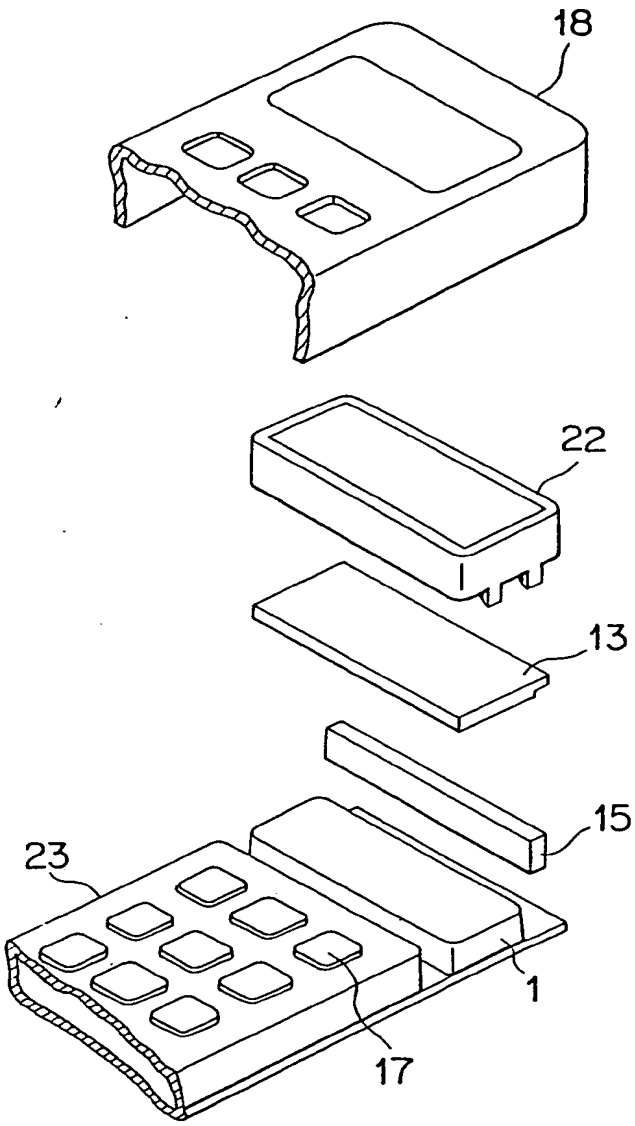
FIG. 7



on the light emitting panel of the body function to decide the traveling directions of light from the light sources not opposing to the light emitting panel, so that the light may travel toward the light guide plate; and the light guide plate functions to prevent lowering in the luminous intensity of the light at positions distant from the light sources; and the prism-worked surface formed at one surface of the light emitting panel functions to efficiently guide the light of the light sources to the light emitting panel, whereby uniform planar light emission is attained.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1a and 1b and Figures 2a and 2b all illustrate an embodiment of this invention, in which Fig. 1a is a front view showing a body with a cover, a liquid crystal displaypanel and a microconnector detached therefrom, Fig. 1a is an exploded vertical sectional view of the body, Fig. 2a is a perspective view showing the front of the body, and Fig. 2b is a perspective view showing the rear of the body.

Figures 3a and 3b and Figures 4a and 4b illustrate other embodiments of this invention, respectively, in which each of Fig. 3a and Fig. 4a is a front view showing a body with a cover, a liquid crystal displaypanel and a microconnector detached therefrom, and each of Fig. 3b and Fig. 4b is an exploded vertical sectional view of the body.

Figures 5a and 5b, Figures 6a and 6b and Figure 7 illustrate prior-art planar light emitting devices of the specified type, in which Fig. 5a and Fig. 6a are front views, Fig. 5b and Fig. 6b are exploded vertical sectional views, and Fig. 7 is an exploded perspective view showing part of a casing for assembling the prior-art planar light emitting device therein.

PREFERRED EMBODIMENTS OF THE INVENTION

Figs. 1a and 1b and Figs. 2a and 2b illustrate one embodiment of this invention. Referring to the figures, numeral 1 designates a body which is made of a transparent synthetic resin. Numeral 2 designates a light emitting panel which is formed with a prism-worked surface 2a being, for example, roughened at the front thereof in correspondence with a liquid crystal displaypanel 13 that is placed on the front at the stage of assemblage, and which has a reflective sheet 10b stuck on a slanting surface 7b that is formed at the rear of the panel. A reflective sheet 10a is stuck on a slanting surface 7a which is formed on one side of the front of this light emitting panel 2. Also, the body 1 formed with the slanting surface 7b is formed with a light guide plate 12 which is thinned in a wedge shape as it becomes more distant from light sources 4 to be described later. Shown at numerals 11 are recesses which correspond to the plurality of light sources 4 such as light emitting diodes (LEDs) disposed at the predetermined positions of a printed circuit board 5 that is placed and mounted on the rear surface of the body 1, and which receive the light sources 4 when the printed circuit board 5 is placed. An accommodating chamber 14 for receiving the liquid crystal displaypanel 13 is formed in the body 1 in correspondence with the light emitting panel 2, and a plurality of ribs 14a and 14b for positioning the liquid crystal displaypanel 13 are formed at the peripheral wall of this accommodating chamber 14. A through hole 16 is provided on one side of the accommodating chamber 14, and receives a microconnector 15 for electrically connecting the liquid crystal displaypanel 13 and the printed circuit board 5. A plurality of key buttons 17 are disposed in the body 1 so as to protrude out of a cover 18, a plurality of spacers 19 serve to fill up the gaps between the liquid crystal displaypanel 13 and the cover 18, and a plurality of reflectors 20 are disposed on the other side of the printed circuit board 5 in order to reflect the light of the light sources 4 toward the liquid crystal displaypanel 13.

The planar light emitting device of this invention is constructed as described above. Therefore, the light emergent from the light sources 4 is led toward the light guide plate 12 by the larger slanting surface 7b as well as the smaller slanting surface 7a formed in the part of the body 1 and the larger reflective sheet 10b as well as the smaller reflective sheet 10a stuck thereto, and it is efficiently diffused within the light guide plate 12 while repeating irregular reflections. The light of the light sources 4 is further diffused so as to become uniform planar light emission by means of the prism-worked surface 2a which is formed at the front of the light emitting panel 2.

Figs. 3a and 3b and Figs. 4a and 4b illustrate other embodiments of this invention, respectively. Fig. 3a or Fig. 4a is a front view showing the body from which the cover, the liquid crystal displaypanel and the microconnector are detached, while Fig. 3b or Fig. 4b is an exploded vertical sectional view of the body. The embodiment of Figs. 3a and 3b is such that the plurality of key buttons 17 explained in the foregoing embodiment are omitted, and that the light sources 4 are held within the recesses 11 provided in the body 1. On the other hand, the embodiment of Figs. 4a and 4b is such that the plurality of light sources 4 are held within the recesses 11 and 11 which are formed on both the sides of the accommodating chamber 14 for the liquid crystal displaypanel 13 as formed in the body 1, while the printed circuit board 5 in the foregoing embodiment is omitted, thereby to reduce the thickness of the planar light emitting device still more. The functional effects of the embodiments are quite the